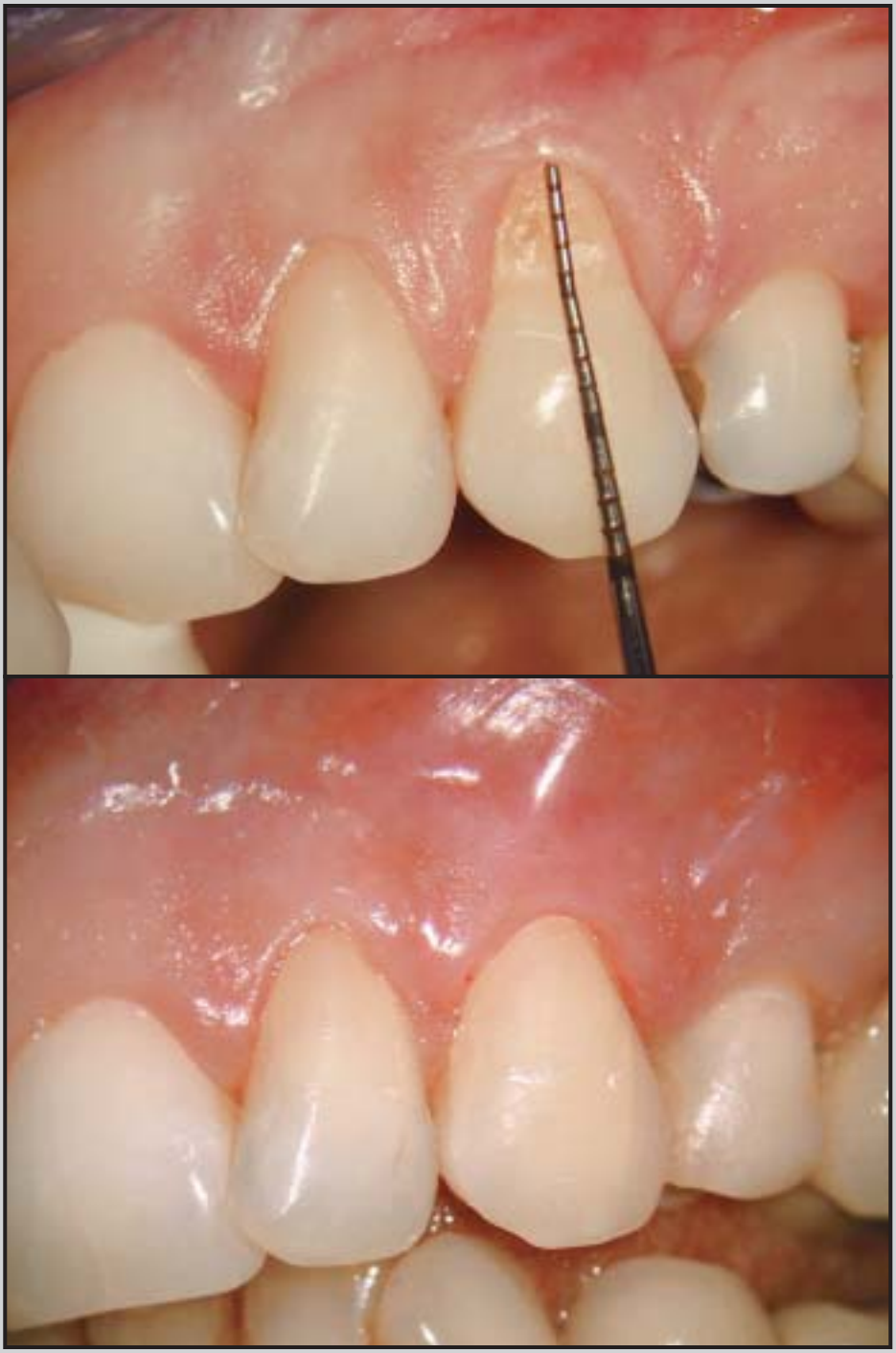

Microsurgical Treatment of Gingival Recession: A Controlled Clinical Study

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When maximum precision is required in performing surgery to satisfy particular esthetic demands, a surgical microscope that enhances complete visualization of the operative field may represent a useful tool. Twenty-four cases of gingival recession (depth 2 to 5 mm) were treated by different mucogingival surgical techniques in 24 patients: 12 procedures were performed with the aid of a surgical microscope (test group), whereas the other 12 patients were treated without the microscope (control group). Recession depth, probing depth, periodontal attachment loss, and keratinized gingival tissue width were recorded at baseline and 12 months following surgery. Three examiners separately evaluated pictures of the final cases on a scale from 1 to 3, focusing on three esthetic parameters (scarring, gingival margin, and papillae appearance). All parameters significantly improved from baseline to 12 months in both groups, except for probing depth, which did not significantly change. Although the outcomes of the test group always showed a major improvement over the controls, no significant differences could be detected between test and control groups. Mean defect coverage at 12 months was 86% and 78% for test and control groups, respectively; complete coverage was achieved in 58.3% and 33.4% of cases, respectively. Qualitative esthetic evaluation showed: (1) *high concurrence among examiners;* (2) *significantly better scarring and marginal profile in the test group; and* (3) *no significant difference in papillae appearance. The application of magnification in mucogingival surgery accomplished better results in terms of success and predictability compared to conventional techniques and might help achieve excellent esthetic outcomes.* (Int J Periodontics Restorative Dent 2005;25:181–188.)

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The physiologic well-being of the patient is a significant factor associated with the success of dental therapy. The solution of an esthetic problem is one of the main reasons many patients with soft tissue recession consult with periodontists. Soft tissue recession is defined as the exposure of the root surface caused by an apical shift of the gingival margin. It is a fairly common condition, with a high prevalence in populations having a high standard of oral hygiene. Besides plaque-induced periodontal inflammation, toothbrushing trauma is considered a major cause of this condition.[1]

According to the American Academy of Periodontology's position paper on mucogingival therapy, esthetic demands, together with reduction of root sensitivity and management of root caries or cervical abrasions, represent the main indications for root coverage.[2] When recession occurs in the so-called esthetic zone, primarily involving the anterior region, esthetic concerns add to biologic and functional problems. The growing attention paid by a large part of society to esthetics

makes the latter an inseparable part of today's dental treatment. To satisfy the desire and need for a healthy and pleasing appearance, modern periodontology has become closely linked to both plastic surgery and esthetic dentistry. A treatment modality addressing both biologic and esthetic demands is today most often required from the periodontal care provider.[3,4]

New technologies, instruments, and surgical techniques are therefore necessary to help the clinician ensure the best results and satisfy the patient's expectations. The surgical microscope has been thoroughly demonstrated as a useful tool in other fields of dentistry such as endodontics.[5] However, the successful use of the surgical microscope in periodontal surgery is scarcely documented; only a few studies address the advantages of the application of magnification to periodontal surgery.[6–9]

In mucogingival surgery, the extent of operative invasion, and consequently of surgical damage to the tissues, might be greatly reduced by: *(1)* an atraumatic surgical approach; *(2)* the dexterity of the surgeon; and *(3)* excellent visualization of the operative field. These factors may be improved by using a surgical microscope. Microsurgery enhances normal vision through magnification and favorable lighting, leading to an improvement in predictability, cosmetic result, and patient comfort levels over conventional periodontal surgical procedures.

The aim of this clinical study was to verify whether the use of a surgical microscope in the surgical treatment of gingival recession could improve the outcome in terms of root coverage and final tissue appearance compared with traditional periodontal surgery. The success criteria of recession treatment cannot be based only on the amount of root coverage obtained. A simple measurement on a central vertical line cannot actually reflect the shape and area of residual recession. Attention therefore needs to be paid to additional factors.[4]

Method and materials

Patient enrollment

In this study, 24 cases of gingival recession were treated. Patients were selected from among those who applied to the Department of Periodontology, University of Milan, for treatment involving problems of esthetics and sensitivity related to their defects. The clinical study protocol and patient consent form were approved by the Institutional Review Board of the university.

The entry criteria were: *(1)* buccal recession at least 2 mm deep; *(2)* no loss of interdental bone or soft tissue (all defects belonged to Class I or II according to Miller's classification[10]); and *(3)* acceptable plaque control after initial therapy. All patients at the time of enrollment had no remarkable medical history, and none presented contraindications to surgical treatment. After an accurate explanation of the surgical procedures and techniques, all patients signed the appropriate informed consent form.

Patients were randomly assigned to two treatment groups according to a computer-generated randomization list. Patients in the test group were treated with the use of a surgical microscope, whereas patients of the control group were treated with conventional surgery. In the preoperative phase, all patients underwent oral hygiene procedures. All of them received detailed oral hygiene instructions to avoid or limit possible habits related to the etiology of their recessions.

Two weeks after the oral hygiene treatment phase, a complete measurement recording of presurgical variables was carried out by a single examiner with a periodontal probe (PCP-UNC 15, Hu-Friedy). The variables measured were: *(1)* recession depth (REC); *(2)* probing depth (PD); *(3)* clinical attachment level (CAL); and *(4)* keratinized gingiva width (KG). All measurements were rounded up to the nearest 0.5 mm. In both groups, the depth of recession varied between 2 and 5 mm; all recessions were located in the anterior (esthetic) area of either the maxilla or mandible. Molars were excluded from the study. All teeth involved were vital and did not present occlusal interferences or restorations. In this phase, presurgical pictures were taken of each site (Fig 1a).

Fig 1a (left) *Case treated with the aid of surgical microscope: pretreatment defect in anterior region.*

Fig 1b (right) *One month after treatment.*

Surgical procedure

Patients assigned to the test group were treated by minimally invasive surgical techniques performed with the aid of a surgical stereomicroscope (Carl Zeiss Omni Pro55). The type of surgical technique was chosen in relation to the anatomic features of the site (ie, recession depth and width, together with quality and quantity of adjacent soft tissue).[1,2,11,12] In this group, the following treatments were performed: six coronally advanced flap (CAF) + connective tissue graft (CTG); one CAF + guided tissue regeneration (GTR) with a resorbable membrane; four CAF + CTG + enamel matrix proteins (EMP); and one semilunar flap. The microscope used had a fiber-optic illumination system, and the magnification varied between 5× and 30×. Appropriate microsurgical instruments were used for the procedures; surgical blades, retractors, scissors, and needle holders were smaller and lighter than conventional ones. Beaver No. 6400 carbide steel blades were used. Among nonresorbable sutures, Gore-Tex CV-6 (WL Gore) and Ethilon No. 6.0 (Ethicon/Johnson & Johnson) were chosen, whereas Monocryl No. 5.0 (Ethicon/Johnson & Johnson) was used as a resorbable suture.

In the control group, procedures to cover gingival recession were performed without the use of the surgical microscope. Here again, the choice of the most suitable technique for each case strictly depended on the depth of recession and quantity and quality of adjacent soft tissue. In this group, the following treatments were performed: nine CAF + CTG; one CAF + GTR; and two CAF. Conventional instruments were used for the surgical procedures.

Patients in both groups underwent the same postsurgical care. After surgery, patients were advised not to chew in the area of the treated site and to temporarily suspend mechanical oral hygiene procedures. Two rinses a day with a solution of 0.12% chlorhexidine digluconate (EburOs, Dentsply) were recommended for plaque control until suture removal. No antibiotic therapy was prescribed. Sutures were removed 7 days after surgery. Thereafter, patients continued chemical plaque control of the treated sites by topical application of 0.2% chlorhexidine spray (EburOs Spray, Dentsply).[13] After 4 weeks, patients were allowed to start brushing in the area with an extra-soft toothbrush, using a gentle roll technique.

Postsurgical follow-up

After the surgical procedure, periodic recall appointments were scheduled for all patients at days 7 and 15, and thereafter at 1, 4, 7, 10, and 12 months. At each of these appointments, oral hygiene was performed; furthermore, the course of surgical wound healing and the general aspect of the treated site were controlled, and the occurrence of adverse events was documented. Figure 1b shows the same case shown in Fig 1a, 1 month after treatment.

At the 12-month follow-up, the same outcome variables measured in the preoperative phase (REC, PD,

Table 1 Mean and standard deviation of variables measured at baseline and 12 months in test and control groups (mm)

Variable	Test group			Control group		
	Baseline	12 mo	Gain	Baseline	12 mo	Gain
REC	3.17 ± 1.01	0.55 ± 0.69	2.67 ± 0.87	3.38 ± 1.11	0.73 ± 0.75	2.63 ± 0.91
PD	1.63 ± 0.68	1.75 ± 0.43	0.13 ± 0.61	2.00 ± 0.60	2.21 ± 0.58	0.21 ± 0.89
CAL	4.79 ± 1.31	2.17 ± 0.92	2.63 ± 0.86	5.33 ± 1.21	2.86 ± 1.03	2.38 ± 1.15
KG	2.25 ± 1.25	4.04 ± 0.99	1.79 ± 0.69	2.73 ± 0.56	4.29 ± 1.57	1.70 ± 1.51

REC = recession depth; PD = probing depth; CAL = clinical attachment level; KG = keratinized gingiva width.

CAL, KG) were assessed. In the same session, pictures were taken of the treated areas with a digital camera (Nikon Coolpix 990) mounted on the microscope to record the esthetic result.

Subsequently, in a different session, three blinded examiners subjectively evaluated the pre- and postsurgical pictures. The examiners studied the pictures separately, and none of them knew either the surgical technique used or to which group each patient belonged. They had to judge mainly the esthetic aspect of the treated site, ignoring the quantity of root coverage; they were asked to focus on the quality of the marginal tissues. The three aspects considered were scar appearance, marginal profile, and papillae appearance. The examiners were asked to assign a score to each esthetic parameter for every picture according to the following scale: 1 = unsatisfactory outcome; 2 = good outcome; or 3 = excellent outcome.

Data analysis

The differences between the preoperative and 12-month postoperative measurements within each group were examined by the paired Student's *t* test. The difference between test and control groups was evaluated for each of the measured parameters by unpaired Student's *t* test.

Regarding the esthetic qualitative evaluation, the correlation between data from the three observers was evaluated for the three possible combinations (examiner 1 vs examiner 2, 2 vs 3, and 1 vs 3) by Spearman's rank test. After assessing the concurrence among examiners, test and control groups were compared for each of the three esthetic parameters by the chi-square test.

Results

No adverse events were recorded during the postoperative period. Table 1 reports the mean values of the variables measured at baseline and 12 months after surgery for both test and control groups. Table 2 gives the results of the paired Student's *t* test performed to compare baseline and 12-month evaluations for both test and control groups. Table 3 gives the results of the unpaired Student's *t* test performed to compare test and control groups for each parameter evaluated. With regard to baseline values, the comparison between the two groups for all periodontal parameters evaluated showed no statistically significant difference.

Test group

In this group, the preoperative REC ranged from 2 to 5 mm, with a mean of 3.17 ± 1.01 mm. Twelve months after surgery, this variable significantly decreased, to a mean of 0.55 ± 0.69 mm (range 0 to 2 mm). The mean defect coverage in this group was 86%. PD was not significantly changed at 12 months

with respect to the baseline values. Conversely, CAL significantly improved, from 4.79 ± 1.31 mm to 2.17 ± 0.92 mm. KG significantly increased by 1.79 ± 0.69 mm at 12 months with respect to the baseline value.

From an esthetic point of view, it is most important to analyze the distribution in percentage of defect coverage. For this reason, final results were divided into four main categories on the basis of the amount of residual recession (Fig 2); 58.3% of patients treated with the microscope obtained complete root coverage (residual recession = 0). In only 25.0% of cases did a residual recession of up to 1 mm persist; the remaining 16.7% of residual recessions were between 1 and 2 mm. Table 4 reports the mean results of the esthetic qualitative evaluation of scarring, gingival margin, and papillae appearance. No statistical difference between examiners could be shown for any of the esthetic parameters evaluated.

Table 2 Comparison between baseline and 12-month evaluations for test and control groups*

Variable	*t*	*P*	Significant
Test group			
REC	10.12	< .010	Yes
PD	0.71	.490	No
CAL	10.62	< .010	Yes
KG	8.60	< .010	Yes
Control group			
REC	8.71	< .010	Yes
PD	0.81	.440	No
CAL	5.44	< .010	Yes
KG	3.46	< .010	Yes

*Performed by paired Student's *t* test.
REC = recession depth; PD = probing depth; CAL = clinical attachment level; KG = keratinized gingiva width.

Table 3 Comparison between test and control groups for both baseline and difference with respect to baseline (Δ, mm) at 12 months*

Variable	*t*	*P*	Significant
REC			
Baseline	0.27	.790	No
Δ	0.11	.910	No
PD			
Baseline	1.39	.180	No
Δ	0.27	.790	No
CAL			
Baseline	0.83	.420	No
Δ	0.60	.550	No
KG			
Baseline	1.24	.230	No
Δ	0.51	.620	No

*Performed by unpaired Student's *t* test (*P* = .050 was chosen as the level of significance).
REC = recession depth; PD = probing depth; CAL = clinical attachment level; KG = keratinized gingiva width.

Control group

Twelve months after treatment, mean REC was significantly decreased, by 2.63 ± 0.91 mm; mean defect coverage was 78% (Table 1). PD did not significantly change after 12 months, whereas CAL significantly improved, from 5.33 ± 1.21 mm to 2.86 ± 1.03 mm. At the 12-month follow-up, KG had significantly increased, by 1.70 ± 1.51 mm. In this group, complete coverage was achieved in only 33.3% of patients; most (58.3%) presented a 12-month postsurgical defect of up to 1 mm. Only one case had a postsurgical residual recession amounting to 2.5 mm.

With regard to the esthetic evaluation, this group showed no statistically significant differences between examiners for any of the esthetic parameters evaluated. Comparing test and control groups for the three esthetic parameters, significant differences were demonstrated by the chi-square test for

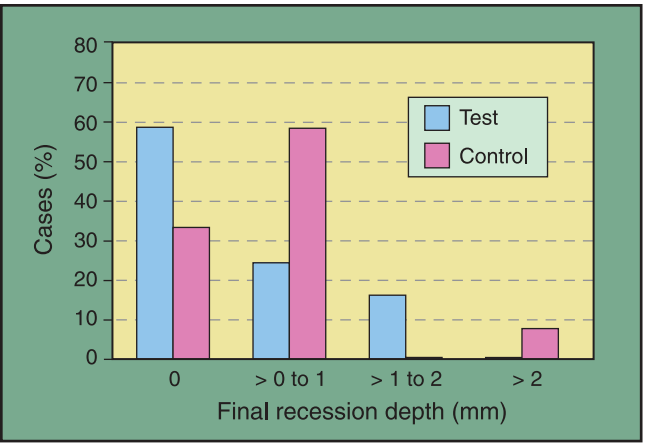

Fig 2 *Distribution of residual recession 12 months after surgery.*

Table 4 Results of esthetic evaluation

Parameter	Test group	Control group
Scarring	2.50 ± 0.60	2.22 ± 0.60
Marginal profile	2.64 ± 0.60	2.22 ± 0.60
Papillae appearance	2.47 ± 0.60	2.44 ± 0.70

scarring ($P = .016$) and gingival margin ($P = .003$), in favor of the test group. Conversely, no significant difference was found between groups for papillae appearance. Figure 3 shows an example of a case treated by conventional surgery that required further gingivoplasty to improve esthetic results.

Discussion

The success criteria of treatments performed to improve esthetics may be quite different compared to those surgical procedures whose main goals are to improve periodontal health and restore compromised function.[14] The aim of this clinical study was to evaluate the advantage of magnification in mucogingival surgery when performed to treat both the periodontal condition and improve the esthetic result.

The same skilled operator, whose training with the surgical microscope lasted about 1 year, performed all surgical procedures. The duration of such training may appear considerably limited compared with all the years one has to spend refining the skills of conventional periodontal surgery.

Success in the treatment of gingival recession in terms of esthetics (often a major concern of patients) may be considered related to the final amount of original defect coverage. The results obtained in our study deserve some interest. Original defect coverage ranged in both groups from 50% to 100%; in the control group, the mean value was 78%, whereas in the test group, it reached 86%. This difference was not statistically significant ($P = .330$), mainly because of the low number of cases examined. From Fig 2, one may conclude that the predictability of treatment (defined as the percentage of cases that achieved complete coverage in respect to total treated cases) was higher for patients treated with the microscope (58.3% vs 33.4%). In the control group, the prevalent outcome was residual recession ranging between 0 and 1 mm.

Based on the present data, it is possible to assert that patients who underwent microsurgery had better results in terms of both success and predictability compared to those treated by conventional surgery. A comparison between the clinical cases presented in Figs 1 and 3 illustrates this concept. The patient treated by conventional periodontal surgery had to undergo further treatment because of an unsatisfying esthetic outcome.

The present findings are supported by other clinical studies concerning the advantages of microsurgery in periodontology.[15,16] In particular, one clinical report demonstrates the advantages of the microsurgical approach in treating root coverage by free connective tissue graft.[16] That study found faster heal-

Fig 3a *Case treated by conventional surgery: pretreatment defect.*

Fig 3b *To improve esthetic outcome, gingivoplasty is performed after 5 months.*

Fig 3c *Final result at 2 years.*

Fig 4a *Wound closure in a case treated with the aid of surgical microscope: day of surgery.*

Fig 4b *Seven days after surgery, at suture removal.*

Fig 4c *Fifteen days after surgery. Note excellent closure of the wound margins.*

ing and vascularization in microsurgically treated sites compared to those receiving conventional (macrosurgical) care. Therefore, the use of the surgical microscope in mucogingival therapy might be helpful, especially for those sites where esthetics demand complete and perfect coverage (high success and predictability required). Conversely, traditional surgery should be limited to areas of less esthetic importance, such as the mandibular anterior or posterior regions.

High magnification and proper instrumentation, although allowing greater precision during surgical procedures, cannot by themselves eliminate all possible causes of failure related to mucogingival treatment. Sometimes, failures are completely unrelated to either the surgeon's ability or techniques used. The failures may simply be related to the patient's lack of compliance postsurgically or other unpredictable events, irrespective of the use of the microscope.

In modern periodontology, success criteria for the treatment of gingival recession should not be based only on the amount of root coverage obtained. It is also important to evaluate integration of the gingival recession within the mouth. Attention, then, needs to be paid to additional factors such as the visual aspect of the graft and surrounding tissues.[4] Root coverage procedures should lend a natural aspect and harmony (usually reflected by a healthy appearance) to treated tissues.

To achieve an excellent result in terms of both esthetics and function, it is fundamental to perform extremely fine and accurate incisions, meticulous suturing to promote stabilization and immobilization of the

graft,[14] and precise closure of wound margins. Magnification of the structures, together with proper lighting, improves recognition of tissue elements and may facilitate these operative procedures. Figure 4 illustrates wound closure and tissue healing of a case treated with the aid of the microscope.

An undetectable scar is not the only factor to determine a good result. The involved papillae should also have a pleasing and healthy appearance, and the gingival line should follow a course harmonious with the rest of the mouth. According to the esthetic evaluation performed by three independent examiners, the comparison of these three factors between the groups (Table 4) showed that the test group achieved slightly better outcomes.

These results may justify the interest in the application of the surgical microscope, and of magnification in general, to the field of periodontology. The microscope, used by a highly skilled surgeon, may represent a helpful tool for periodontists dealing with modern periodontal surgery as well as esthetic dentistry. The relatively small sample size of the present study is a limiting factor for the power of the statistical analysis, although the excellent outcomes observed are promising. Further prospective investigations with a larger database are needed to confirm the encouraging results of the present preliminary study.

References

1. Tugnait A, Clerehugh V. Gingival recession—Its significance and management. J Dent 2001;29:381–394.
2. Consensus report. Mucogingival therapy. Ann Periodontol 1996;1:702–706.
3. Nowzari H. Aesthetic periodontal therapy: Introduction. Periodontol 2000 2001;27:7.
4. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. Periodontol 2000 2001;27: 97–120.
5. Carr GB. Surgical endodontics. In: Cohen S, Burns RC (eds). Pathways of the Pulp. St Louis: Mosby, 1994:531.
6. Tibbets LS, Shanelec D. Periodontal microsurgery. Dent Clin North Am 1988;42: 339–359.
7. Michaelides PL. Use of the operating microscope in dentistry. J Calif Dent Assoc 1996;24(6):45–50 [erratum 1996;24(10):9].
8. Shanelec DA, Tibbets LS. A perspective on the future of periodontal microsurgery. Periodontol 2000 1996;11:58–64.
9. Belcher JM. A perspective on periodontal microsurgery. Int J Periodontics Restorative Dent 2001;21:191–196.
10. Miller PD Jr. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5(2):9–13.
11. Wennström JL. Mucogingival therapy. Ann Periodontol 1996;1:671–701.
12. American Academy of Periodontology. Parameter on mucogingival conditions. J Periodontol 2000;71(suppl 5):861–862.
13. Francetti L, Del Fabbro M, Testori T, Weinstein RL. Chlorhexidine spray versus chlorhexidine mouthwash in the control of dental plaque after periodontal surgery. J Clin Periodontol 2000;27: 425–430.
14. Camargo PM, Melnick PR, Kennedy EB. The use of free gingival grafts for aesthetic purposes. Periodontol 2000 2001; 27:72–96.
15. Cortellini P, Tonetti MS. Microsurgical approach to periodontal regeneration. Initial evaluation in a case cohort. J Periodontol 2001;72:559–569.
16. Burkhardt R, Hürzeler MB. Utilization of the surgical microscope for advanced plastic periodontal surgery. Pract Periodontics Aesthet Dent 2000;12: 171–180.